(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
10 May 2007 (10.05.2007)

PCT

(10) International Publication Number
WO 2007/052975 A1

(51) International Patent Classification:
*A61B 17/70* (2006.01)

(21) International Application Number:
PCT/KR2006/004576

(22) International Filing Date:
3 November 2006 (03.11.2006)

(25) Filing Language: Korean

(26) Publication Language: English

(30) Priority Data:
10-2005-0105078 3 November 2005 (03.11.2005) KR
10-2006-0106232 31 October 2006 (31.10.2006) KR

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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KZ, LA, LC, LK, LR, LS, LT, LU, LV, LY, MA, MD, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

**Published:**
— *with international search report*

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

WO 2007/052975 A1

**(54) Title:** FIXING DEVICE FOR SPINOUS PROCESS

**(57) Abstract:** Disclosed is a device for fixing spinous process, including an extension arm extended to a spinous process of an adjacent vertebra, a first fixing unit provided at one end of the extension arm, and a second fixing unit that is inserted and guided in the extension arm to face the first fixing unit, wherein the first fixing unit supports one side of the spinous process and the second fixing unit supports the other side of the spinous process to thereby fix the spinous process of the adjacent vertebra. The spinous process fixing device of the present invention is can fix diverse adjacent spinous processes, thereby preventing degenerative deformity on the spine after back surgery. Moreover, the spinous process fixing device of the present invention is excellent in compatibility and thus can be applied to most of vertebra fixing devices.

# Description

# FIXING DEVICE FOR SPINOUS PROCESS

## Technical Field

[1] The present invention relates to a fixing device for spinous process. More particularly, the invention relates to a device which has an extension arm attached to a vertebra fixing device for fixing a vertebra having received a spinal disk removal operation and an adjacent vertebra with a vertebra screw and a rod, and which uses a first fixing unit and a second fixing unit for holding spinous processes of the adjacent vertebra to the operated vertebra with a vertebra screw, to thereby prevent degenerative deformity on the adjacent vertebra after back surgery.

## Background Art

[2] The spine is formed by a plurality of vertebrae that are connected to each other in a vertical direction. Each vertebra is constituted by a plurality of unit vertebral bodies that are connected to each other in a vertical direction with disks interposed therebetween, a spinous process joined with each unit vertebral body as one body and extended towards the back of a body, transverse processes protrusively extended to the left and right sides, respectively, and induced processes located between the spinous process and the transverse processes. Also, there is formed a vertebral foramen between each of the vertebral bodies and the spinous process for a vertebral nerve to pass through vertically, wherein the vertebral foramen is extended along a longitudinal direction of the vertically connected vertebral bodies.

[3] A vertebra fixing device is a device for treating a patient with vertebra damages due to fracture, degenerative changes or disease by an operation. That is, in case of a patient with a vertebral fracture, the vertebra fixing devices are implanted in each vertebra of the patient's spine to interconnect the vertebras in order to help the recovery of the spine back to normal state.

[4] As shown in FIGs. 1 and 2, when a spinal problem occurs, a vertebra screw 20 is implanted between an induced process 135 and a transverse process 132 per defective vertebra, and rods 21 are disposed on the head of the implanted vertebra screw and fixed by nuts 201 so that the operated vertebras can be held firmly with each other. In addition, connecting members 23 are attached to the rods 21 mounted on both sides, and transverse bars 22 are insertedly fixed thereto to interconnect the rods on both sides, thereby more firmly supporting the vertebras.

[5] However, this conventional vertebra fixing device simply serves to hold the operated vertebras firmly to each other, so the vertebras cannot move in any direction. Therefore, vertebras adjacent to the fixed vertebra have to move excessively and thus

an excessive load is applied to those adjacent level, which may cause degenerative chagnes to adjacent spinal segments. For example, referring to FIG. 1, if spondylodesis is performed on vertebras 12, 13 and 14, these vertebras 12, 13 and 14 become fixed firmly, and therefore, an excessive load is applied to vertebras 10 or 11 and 15 or 16, thereby causing degenerative deformity to those vertebras.

[6] In general, about 30 to 50% of patients who had spondylodesis experiences degenerative changes in 4 to 5 years after the surgery. When the degenerative change occurs like this, a reoperation is inevitable. During the reoperation, the previously inserted pedicle screws and rods should be removed and new screws should be inserted again. Unfortunately, this may give much pain accompanied with a high risk of infection.

## Disclosure of Invention

## Technical Problem

[7] It is, therefore, a primary object of the present invention to provide a fixing device for spinous process, through which a load upon adjacent vertebras can be divided by holding spinous processes of the adjacent vertebras, the adjacent vertebras can move within a limited range even after the fixation, and further degenerative deformity occurring in the adjacent vertebral level can be prevented.

[8] Another object of the present invention is to provide a fixing device for spinous process which is fully compatible with any of existing vertebra fixing devices.

[9] Still another object of the present invention is to provide a fixing device for spinous process, which is capable of fixing many spinous processes all together.

## Technical Solution

[10] According to a first embodiment of the invention for achieving the above objects, there is provided a fixing device for spinous process for use in a vertebra fixing device comprising vertebra screws implanted in a vertebra and rods for fixing the vertebra screws to each other, the device comprising: an extension arm extended from a spinous process; a first fixing unit prepared at one end of the extension arm; a second fixing unit that is inserted and guided in the extension arm to face the first fixing unit, wherein the first fixing unit supports one side of the spinous process and the second fixing unit supports the other side of the spinous process to thereby fix the spinous process.

[11] According to a second embodiment of the invention, the spinous process fixing device is characterized in that the first fixing unit in the first embodiment is detachably attached to the extension arm, and comprises an insertion tube inserted into the extension arm and a hook attached to one end of the insertion tube.

[12] According to a third embodiment of the invention, the spinous process fixing

device is characterized in that the extension arm in the first embodiment further comprises a moving means formed at a predetermined position on the upper side of the first fixing unit, and the second fixing unit is guided while riding on the moving means of the extension arm.

[13] According to a fourth embodiment of the invention, the spinous process fixing device is characterized in that the moving means in the third embodiment is a screw thread formed on the outer circumferential surface of the extension arm.

[14] According to a fifth embodiment of the invention, the spinous process fixing device is characterized in that the moving means in the fourth embodiment comprises ratches formed on the outer circumferential surface of the extension arm.

[15] According to a sixth embodiment of the invention, the spinous process fixing device is characterized in that the second fixing unit in the first or fourth embodiment comprises: an insertion tube inserted into the extension arm and guided; a main hook attached to one side of the insertion tube; and an auxiliary hook extended downwardly from a predetermined position of the main hook at a predetermined angle of inclination.

[16] According to a seventh embodiment of the invention, the spinous process fixing device is characterized in that the second fixing unit in the fifth embodiment comprises: an insertion tube inserted into the extension arm and guided; a main hook attached to one side of the insertion tube; and an auxiliary hook extended downwardly from a predetermined position of the main hook at a predetermined angle of inclination, wherein the insertion tube has a projection formed on an upper end part thereof for interworking with the ratches of the extension arm.

[17] According to an eighth embodiment of the invention, the spinous process fixing device is characterized in that the insertion tube of the second fixing unit in the sixth embodiment is inserted into the extension arm and then position-fixed to the extension arm by bolts provided at the lateral surface thereof.

[18] According to a ninth embodiment of the invention, the spinous process fixing device is characterized in that the insertion tube of the second fixing unit in the sixth embodiment is inserted into the extension arm and then position-fixed to the extension arm by nuts that are arranged at the upper and lower parts of the insertion tube and screwed onto a screw thread of the extension arm.

[19] According to a tenth embodiment of the invention, the spinous process fixing device is characterized in that the extension arm in the first embodiment is connected to a transverse bar of the vertebra fixing device through a connection member.

[20] According to an eleventh embodiment of the invention, the spinous process fixing device is characterized in that the extension arm in the first embodiment is connected via a connection member attached onto a rod of the vertebra fixing device.

[21] According to a twelfth embodiment of the invention, the spinous process fixing device is characterized in that the connection member in the tenth embodiment comprises: a transverse bar fixing unit of a predetermined length to which the transverse bar is insertedly fixed; and an extension arm fixing unit which is disposed to be intersected with the transverse bar fixing unit and into which the extension arm is insertedly fixed.

[22] According to a thirteenth embodiment of the invention, the spinous process fixing device is characterized in that the transverse bar fixing unit in the twelfth embodiment is a hollow tube shaped member into which the transverse is insertedly fixed, the extension arm fixing unit is a hollow tube shaped member to which the extension arm is insertedly fixed, and the transverse bar and the extension arm are fixed by bolts that pass through each of the hollow tube shaped members.

[23] According to a fourteenth embodiment of the invention, the spinous process fixing device is characterized in that the transverse bar fixing unit in the twelfth embodiment is a member that is slidingly inserted into lateral sides of the transverse bar in a plate shape with a guide slot formed on lateral surfaces, and the extension arm fixing unit is a hollow tube shaped member which is provided at a predetermined position of the transverse bar fixing unit and to which the extension arm is insertedly fixed, the transverse bar fixing unit being position fixed by bolts that are screwed into plural through holes arranged at the plate-shaped transverse bar at regular intervals and the extension arm fixing unit being connected to the extension arm by bolts

[24] According to a fifteenth embodiment of the invention, the spinous process fixing device is characterized by comprising: a first fixing unit comprised of a head portion formed over an upper portion of the spinous process and a first extension arm extended from the head portion; a second extension arm extended from the head portion to be in parallel with the first extension arm; and a second fixing unit for fixing the spinous process by passing through the first and the second extension arms and supporting a lower portion of the spinous process. The spinous process fixing device of this embodiment may include a plurality of second fixing units to thereby fix many spinous processes all together.

[25] According to a sixteenth embodiment of the invention, the spinous process fixing device is characterized by further comprising: a transverse bar for interconnecting a pair of opposite rods of a vertebral fixing device when the spinous process fixing device is implanted into a patient’s body; and a connecting member for fixing the first and the second fixing units to the transverse bar.

[26]

## Advantageous Effects

[27] As mentioned above and as will be described below, the present invention includes the extension arm extended from a predetermined position of the transverse bar or the rod of the vertebra fixing device operated on vertebras, and the first and the second fixing units formed on one end of the extension arm for holding spinous processes of adjacent vertebras, so that a load upon the adjacent vertebras can be divided, the adjacent vertebras can move within a limited range even after the fixation, and further degenerative changes that may occur in the adjacent level can be prevented.

[28] Furthermore, the spinous process fixing device of the present invention is excellent in compatibility because it can be fully compatible with any of conventional vertebra fixing devices.

[29] Moreover, the spinous process fixing device of the present invention can prevent degenerative changes of adjacent vertebras, whereby the possibility of reoperation accompanied with a high risk of infection and much pain can remarkably be reduced.

[30]

## Brief Description of the Drawings

[31] The above and other objects and features of the present invention will become apparent from the following description of the preferred embodiments given in conjunction with the accompanying drawings, in which:

[32] FIG. 1 is a plan view representing a state that a conventional vertebra fixing device is used;

[33] FIG. 2 is a lateral cross-sectional view of the vertebra fixing device shown in FIG. 1, in which fixing screws are inserted into vertebras;

[34] FIG. 3 is a perspective view representing a state that a device for fixing spinous process according to an embodiment of the present invention is installed in a vertebra fixing device;

[35] FIG. 4 is a perspective view of an example of the extension arm used in the device for fixing spinous process according to the present invention;

[36] FIG. 5 is a perspective view of another example of the extension arm used in the device for fixing spinous process according to the present invention;

[37] FIG. 6 is a perspective view of still another example of the extension arm used in the device for fixing spinous process according to the present invention;

[38] FIG. 7 is a perspective view of an example of the second fixing unit used in the device for fixing spinous process according to the present invention;

[39] FIG. 8 is a lateral cross-sectional view showing a connection relation

[40] between the second fixing unit used in the device for fixing spinous process illustrated in FIG. 7 and the extension arm illustrated in FIG. 4;

[41] FIG. 9 is a perspective view of another example of the second fixing unit used in

the device for fixing spinous process according to the present invention;

[42] FIG. 10 is a lateral cross-sectional view showing a connection relation between the second fixing unit used in the device for fixing spinous process illustrated in FIG. 9 and the extension arm illustrated in FIG. 5;

[43] FIG. 11 is a perspective view of still another example of the second fixing unit used in the device for fixing spinal process according to the present invention;

[44] FIG. 12 is a lateral cross-sectional view showing a connection relation between the second fixing unit used in the device for fixing spinal process illustrated in FIG. 11 and the extension arm illustrated in FIG. 6;

[45] FIG. 13 is a perspective view showing an example of the connection member used in the device for fixing spinous process of the present invention;

[46] FIG. 14 is a perspective view showing another example of the connection member used in the device for fixing spinous process of the present invention;

[47] FIG. 15 is a perspective view representing a state that the connection member shown in FIG. 14 is fixed onto the transverse bar;

[48] FIG. 16 is a plan view representing a state that the device for fixing spinous process of the present invention fixes the front and rear of spinous processes;

[49] FIG. 17 is a rear view representing a state that the device for fixing spinous process of the present invention fixes a lower end part of a vertebral foramen plate;

[50] FIG. 18 is a schematic perspective view of a device for fixing spinous process according to another embodiment of the present invention;

[51] FIG. 19 is a perspective view for explaining a method for connecting the first fixing unit and the second extension arm in the device for fixing spinous process of the present invention;

[52] FIGs. 20 and 21 are schematic perspective views of a device for fixing spinous process according to still another embodiment of the present invention;

[53] FIG. 22 is an exploded perspective view of the device for fixing spinous process shown in FIG. 18;

[54] FIG. 23 is a perspective view representing a state that the device for fixing spinous process shown in FIG. 18 is connected to a vertebral fixing device;

[55] FIG. 24 is a plan view representing a state that the device for fixing spinous process shown in FIG. 18 is connected to a vertebral fixing device;

[56] FIG. 25 is a plan view representing a state that the device for fixing spinous process shown in FIG. 18 is implanted in the spine;

[57] FIG. 26 is a schematic perspective view of a device for fixing spinous process according to still yet another embodiment of the present invention;

[58] FIG. 27 is a schematic perspective view of a device for fixing spinous process according to a further another embodiment of the present invention;

[59] FIG. 28 is a perspective view showing that a cross-section of left and right rod fixing links and of an insertion hole of a lower connecting member is in a square shape;

[60] FIG. 29 is a perspective view showing that a cross-section of left and right rod fixing links and of an insertion hole of a lower connecting member is in a pentagon shape; and

[61] FIG. 30 is a detailed lateral cross-sectional view of the transverse bar with which the left and right rod fixing links are integrated.

[62]

## Best Mode for Carrying Out the Invention

[63] Hereinafter, preferred embodiments of the present invention will be explained in more detail with reference to the accompanying drawings.

[64] FIG. 3 is a perspective view representing a state that a device for fixing spinous process according to an embodiment of the present invention is installed at a vertebra fi xing device. As shown in FIG. 3, the device for fixing spinous process of the present invention includes vertebra screws 20, an extension arm 40 connected to a vertebra fixing device composed of rods 21, a first fixing unit 42 joined or detachably attached to one end of the extension arm, and a second fixing unit 50 inserted into the extension arm 40 and guided to be faced with the first fixing unit.

[65] Since the vertebra fixing device is an already well-known technique prior to a filing date of the present invention, it will not be explained in detail hereinafter.

[66] The extension arm 40 may be connected to a transverse bar 22 of the vertebra fixing device through a connection member 30 as shown in FIG. 3, or, although not shown, may be joined directly with the rod 21 and be extended. The extension arm 40 is a member in a bar shape being extendable to a predetermined length, and has the first fixing unit 42 formed on one end thereof. The first fixing unit is a hook-shaped engaging portion, and may be combined with the extension arm as one body or detachably attached thereto.

[67] FIG. 4 is a perspective view of an example of the extension arm used in the device for fixing spinous process according to the present invention. Referring to FIG. 4, the extension arm 40 is a bar-shaped member of a predetermined length, and has the hook-shaped first fixing unit 42 formed on one end in the form of one body therewith and a plurality of ratches 41 protrusively formed at a predetermined position at regular intervals along the circumferential direction. The first fixing unit 42 is configured to have a certain degree of curvature or size so that it can support one side of a spinous process, as will be explained later. Meanwhile, the ratches 41 function as a moving means helping the second fixing unit 50 shown in FIGs. 7 and 8 move on the extension

arm, and is configured in such a way that the second fixing unit can move in the first fixing unit 42 direction only and not in the opposite direction. As one example, it may be designed that the ratches 41 have an upwardly inclined surface 411.

[68] Referring to FIG. 5 which is a perspective view of another example of the extension arm used in the device for fixing spinous process according to the invention, the extension arm 40' is a bar-shaped member of a predetermined length, and is characterized by having the first fixing unit 42' in a hook shape detachably attached to its one end. The first fixing unit 42' is constituted by a hollow insertion tube 421' in which the extension arm passes through and is fixed, a hook 422' extended from one side of the insertion tube 421' in a convexly curved shape, and a bolt 423' that is inserted by passing through the insertion tube and then fixes the insertion tube 421' to the extension arm with pressure. It is preferred that the extension arm 42' shown in FIG. 5 is used together with the second fixing unit 50' shown in FIG. 9.

[69] Referring to FIG. 6 which is a perspective view of still another example of the extension arm used in the device for fixing spinous process according to the invention, the extension arm 40'' has a structure similar to the extension arm 40' shown in FIG. 4 except that it utilizes a screw thread 41'' as a moving means. It is preferred that this extension arm 40'' is used together with the second fixing unit 50'' shown in FIG. 11.

[70] Although not shown, according to other examples of the present invention, the extension arm shown in FIG. 4 or 6 may be provided with the first fixing unit in detachable/attachable manner, as in FIG. 5.

[71] The second fixing unit 50, 50' or 50'' is inserted along the extension arm 40, 40' or 40'', and serves to fixedly support the spinous process of the adjacent vertebra together with the first fixing unit 42, 42' or 42''. It has a same hook as the first fixing unit, and is disposed to be faced with the hook of the first fixing unit, the hook of the second fixing unit being curved in the opposite direction of the hook of the first fixing unit.

[72] FIG. 7 is a perspective view of an example of the second fixing unit used in the device for fixing spinous process according to the present invention. As shown in FIG. 7, the second fixing unit 50 is constituted by a hollow tube shaped member 51, a main hook 52 extended from one end of the tube member 51 in a concavely curved shape, and an auxiliary hook 53 that is extended from a predetermined position of the main hook 52 and concavely curved at a predetermined angle of inclination with respect to the main hook. The tube member 51 has a projection 511 inwardly protruded to the center from the upper end portion of an inner circumferential surface of a central cavity 512, and the projection 511, as depicted in FIG. 8, enables the second fixing unit 50 to move in the direction of arrow A along the ratches 41 on the extension arm 40, while not to move in the direction of arrow B. That is, the second fixing unit 50 can move to the first fixing unit side along the ratches on the extension arm. Further, as shown in

FIG. 16, the main hook 52 hooks the other side of the spinous process of the adjacent vertebra for its support. Moreover, the auxiliary hook 53 is extended from one side of the main hook, and hooks the upper side of a vertebral foramen of the vertebra for its support. When only the main hook and the first fixing unit are used to hook and support the spinous process, either one may easily be separated from the spinous process by the reason that the spinous process is broken. To prevent such phenomenon, their joint can be maintained more safely and firmly by hooking the upper side of the vertebral foramen with the auxiliary hook.

[73] FIG. 9 is a perspective view of another example of the second fixing unit used in the device for fixing spinal process according to the present invention. Referring to FIG. 9, the second fixing unit 50'is constituted by a hollow tube shaped member 51', and a main hook 52' and an auxiliary hook 53', each hook being extended from one side of the tube member 51' in a concavely curved shape. Since the tube member 51', the main hook 52' and the auxiliary hook 53' are the same as those in FIG. 7 in structures and functions, so explanations thereon will not be provided. The only difference is that the second fixing unit 50' differs from the second fixing unit 50 depicted in FIG. 7 only in that a bolt 511', as shown in FIG. 10, passes through the tube member 51' and then fixes it to the outer circumferential surface of the extension arm 41' with pressure.

[74] FIG. 11 is a perspective view of still another example of the second fixing unit used in the device for fixing spinal process according to the present invention. Referring to FIG. 11, the second fixing unit 50'' is constituted by a tube member 51'', a main hook 52'' extended from one side of the tube member in a concavely curved shape, an auxiliary hook 53'' that is concavely curved from a predetermined position of the main hook, and nuts 511'' provided at each of the top and bottom sides of the tube member. In this configuration, the main hook and the auxiliary hook are the same as those in the previous embodiments, but the tube member 51'' in this embodiment is fixed by using the nuts 511', which are positioned at the top and bottom sides, not the bolt. According to FIG. 12, the nut 511'' on the top, the tube member 51'', and the nut 511' on the bottom are sequentially inserted into the extension arm 40'' shown in FIG. 6, and after the position of the tube member is set, the nuts 511'' on the top and bottom sides are screwed onto the screw thread 41'' of the extension arm to fix the tube member onto the extension arm.

[75] According to another embodiment of the present invention, the device for fixing spinous process may further include the connection member 30 for interconnecting the transverse bar and the extension arm, as shown in FIG. 3.

[76] FIG. 13 is a perspective view showing an example of the connection member 30 used in the device for fixing spinous process of the present invention. Referring to FIG.

13, the connection member 30 is constituted by a transverse bar fixing unit 31 into which the transverse bar is insertedly fixed, and an extension arm fixing unit 32 which intersects with the transverse bar fixing unit and into which the extension arm is insertedly fixed.

[77] The transverse bar fixing unit 31 is a hollow tube shaped member into which the transverse bar 22 is inserted through the central cavity 312 in the core. The transverse bar 22 thus inserted is then fastened onto the tube member by the bolt 311 that passes through the tube member. Likewise, the extension arm fixing unit 32 is a hollow tube shaped member which is disposed to be intersected with the upper side or the lower side of the transverse bar fixing unit, and into which the extension arm is inserted through the central cavity 322 in the core. The inserted extension arm 40, 40' or 40'' is then fixed to the extension arm fixing unit by the bolt 321 that passes through the tube member.

[78] FIG. 14 is a perspective view showing another example of the connection member 30' used in the device for fixing spinous process of the present invention. According to FIG. 14, the transverse bar fixing unit 31' of the connection member 30' has a pre-determined length in a longitudinal direction, and its end portions on both sides are inwardly bent, thereby forming insertion projections 313' that are protruded towards the transverse bar insertion hole 312'. Also, an insertion hole (not shown) into which the bolt 311' can be inserted is formed on the top surface of the connection member 30'. Further, the extension arm fixing unit 32' has the same structure as the extension arm fixing unit 32 in the previous embodiment. This connection member 30' may be used together with a plate-shaped transverse bar 22' shown in FIG. 15. The transverse bar 22' is a plate shape member, and has an insertion slot 221' formed on the edges of both sides so that the insertion projections 313' of the transverse bar fixing unit 31' can be inserted and guided. In addition, screw holes 222' into which the bolts 311' are fitted are formed on a top surface of the transverse bar. The screw holes 222' are formed at regular intervals along the longitudinal direction of the transverse bar, so it is possible to arbitrarily change the fixing position of the connection member 30'. And, once the position of the connection member 30' is determined, the bolts 311' are inserted into the screw holes 222' and fixed thereto.

[79] Now, it will be described how the spinous process fixing device of the present invention can be used. FIG. 16 is a plan view representing a state that the spinous process fixing device of the present invention is used for fixing the front and rear of spinous processes. As shown in FIG. 16, vertebra screws 20 are first implanted in vertebras 12, 13 and 14, and then rods 21 are mounted on their heads and fixed through nuts 201. Thereafter, the rods on both sides are interconnected by using the transverse bar 22, so that vertebras with spondylopathy are stably fixed to each other. Next, the

second fixing unit 50 is inserted into the extension arm 40, the hook 42 of the first fixing unit 42 attached to one end of the extension arm hooks and supports one side of each of the spinous processes 111, 151 and 161 of the adjacent vertebra, the other end of the extension arm is fixed to the connection member 30, and the tube member 51 of the second fixing unit 50 is translated along the ratches 41 of the extension arm, thereby suspending the other side of each of the spinous processes 111, 151 and 161 for its support. The projection 511 of the tube member 51 can move only in one direction along the ratches 41 of the extension arm; and therefore, once the final position of the second fixing unit 50 is set, there is no way for retreating the second fixing unit 50 in the opposite direction. Of course, it is natural that the extension arms shown in FIGs. 5 and 6 and the second fixing units shown in FIGs. 7, 9 and 11, which are other embodiments of the invention, may also be employed.

[80] FIG. 17 is a rear view representing a state that the device for fixing spinous process of the present invention fixes a lower end part of a vertebral foramen plate. As shown therein, the auxiliary hook 53 is extended from one side of the main hook 52, and fixes and supports the upper sides of the vertebral foramens 103, 113, 153 and 163 of the vertebra. Therefore, the spinous processes can be fixed more stably with aid of the auxiliary hook as above, compared with a case where the spinous processes are fixed by using only the hook of the first fixing unit and the main hook of the second fixing unit.

[81] As described above, when the spinous processes of adjacent vertebras are fixed by the extension arm, the vertebra with the spinous processes fixed by the first and the second fixing units can have an increased range of movement compared with the vertebra fixed by the conventional vertebra fixing device. Therefore, patients can get more help in terms of convenience of movement in their lives even after back surgery.

[82] In another aspect, a spinous process fixing device according to the present invention is characterized by including: a first fixing unit consisting of a head portion formed over an upper portion of the spinous process and a first extension arm extended from the head portion; a second extension arm extended from the head portion to be in parallel with the first extension arm; and a second fixing unit for fixing the spinous process by passing through the first and the second extension arms and supporting a lower portion of the spinous process.

[83] FIG. 18 is a schematic perspective view of a device for fixing spinous process according to another embodiment of the present invention. Referring to FIG. 18, the device for fixing spinous process of the present invention includes a first fixing unit 1110, a second extension arm 1120, and a second fixing unit 1130, wherein the first fixing unit 1110 is constituted by a head portion 1005 placed over an upper portion of the spinous process and a first extension arm 1007 extended from the head portion in a

longitudinal direction of the spine. Although there is no limit to the shape of the head portion 1005, it preferably has a curved surface on both edges to be suspended on the spinous process. The head portion 1005 and the first extension arm 1007 may be formed as one body or configured separately from each other.

[84] FIG. 19 is a perspective view for explaining a method for connecting the first fixing unit 1110 with the second extension arm 1120 in the device for fixing spinous process of the present invention. As depicted in FIG. 19, it is preferred that the second extension arm 1120 is configured detachably from the first fixing unit 1110 for convenience of the operation procedure. In particular, in case where the spinous process fixing device of the present invention is implanted into a body, the first fixing unit 1110 having the head portion 1005 and the first extension arm 1007 can be first positioned at a spinous process to be fixed and then the second extension arm 1120 can be fixed onto the head portion 1005 of the first fixing unit 1110. In order to fix the second extension arm 1120 onto the head portion 1005 in this manner, a male screw thread is formed on one tip of the second extension arm 1120 and a female screw thread is formed on the inner circumferential surface of a screw hole provided in the head portion 1005. Conversely, a screw hole having a female screw thread formed on its inner circumferential surface may also be formed on the tip of the second extension arm 1120, while one tip of the head portion 1005 may have a protrusion in the form of a male screw thread.

[85] The second fixing unit 1130 includes two insertion holes through which the first and the second extension arms 1007 and 1120 pass, and may have at least one screw hole that is used for fixing the second fixing unit 1130 onto the first and the second extension arms 1007 and 1120. The second fixing unit 1130 includes a concavely curved portion corresponding to the curved surface of the head portion 1005 of the first fixing unit at its contact areas with a spinous process.

[86] Even though the first extension arm 1007 and the second extension arm 1120 in this embodiment are cylindrical tubes, they are not limited thereto, but may be embodied in diverse polygonal forms such as a square pillar, a pentagon pillar and the like, or in a thin wire form.

[87] The spinous process fixing device of the present invention may be employed by connecting to a vertebral fixing device. The vertebral fixing device is constituted by vertebra screws 23 implanted into a vertebra and rods 21 connecting the vertebra screws 23 for remedying the vertebra. In effect, the spinous process fixing device of the present invention may be applied to any type of existing vertebral fixing devices.

[88] A vertebral fixing device according to another embodiment of the present invention includes a structure for connecting the spinous process fixing device of the present invention thereto. Referring to FIG. 20, the spinous process fixing device according to

another embodiment of the invention may further include a transverse bar 1140 for interconnecting opposite rods of the vertebral fixing device, and a connecting member 1200 for fixing the first and the second extension arms 1007 and 1120 of the first fixing unit 1110 to the transverse bar 1140.

[89] Referring to FIG. 21, the transverse bar 1140 has two rod fixing links 1141 and 1141' formed on the left and right sides, each of which has a rod insertion part 1143 or 1143' into which each rod is inserted. Here, these left and right rod fixing links 1141 and 1141' are interconnected by the connecting member 1200. The rod insertion parts 1143 and 1143' may be configured to have a curvature or size enough to encompass the rods of the vertebral fixing device. Screw holes 1147 and 1147' are drilled into the upper surfaces of the rod insertion parts 1143 and 1143' of the left and right rod fixing links 1141 and 1141', respectively. Thus, the transverse bar 1140 can be fixed between the pair of rods by inserting the rods into the rod insertion parts 1143 and 1143' and then fastening a bullet shape screw into each of the screw holes.

[90] The connecting member 1200 includes a lower connecting member 1150 for connecting the left and right rod fixing links 1141 and 1141' of the transverse bar 1140, and an upper connecting member 1160 for fixing the first and the second extension arms 1107 and 1120 to the transverse bar 1140. Mount grooves are formed on the top surface of the lower connecting member 1150 and on the bottom surface of the upper connecting member 1160 so as to hold the first and the second extension arms 1107 and 1120, respectively.

[91] More specifically, the upper connecting member 1160 has mount grooves 1161 and 1162 for holding parts of the first and the second extension arms. Similarly, the lower connecting member 1150 has mount grooves 1151 and 1152 for holding other parts of the first and the second extension arms. Therefore, if the upper connecting member 1160 and the lower connecting member 1150 are joined together, holes that correspond to the two insertion holes of the second fixing unit 1130 are formed and the first and the second extension arms 1007 and 1120 are insertedly fixed thereinto.

[92] FIG. 22 is an exploded perspective view of the device for fixing spinous process shown in FIG. 18. A detailed structure of each of the components in the present invention and a method for interconnecting them will be explained below.

[93] Referring to FIG. 22, the lower connecting member 1150 includes an insertion hole 1153 to which extension bars of the left and right rod fixing links are eccentrically inserted, two screw holes 1156 and 1157 for fixing the lower connecting member 1150 to the transverse bar 1140, and two screw holes 1154 and 1155 for connecting the upper connecting member 1160 to the lower connecting member 1150.

[94] The upper connecting member 1160 includes at least one screw hole 1163 and/or 1164 that is used for fixing the upper connecting member 1160 to the low connecting

member 1150 after the first and the second extension arms 1007 and 1120 are inserted to the mount grooves between the upper and the lower connecting members.

[95] In the spinous process fixing device of this embodiment, the first fixing unit 1110 and the second extension arm 1120 are first inserted to the two insertion holes of the second fixing unit 1130 and screw nails are then fastened into the screw holes 1133 and 1135.

[96] The insertion hole 1153 of the lower connecting member is formed of two hollow tube shaped holes adjacently arranged side by side, so that extension bars 1145 and 1145' of the left and right rod fixing links 1140 and 1140' may be inserted thereinto, respectively. In order to make sure that the extension bars 1145 and 1145' of the left and right rod fixing links do not move, screws are fastened to the screw holes 1154, 1155, 1156, and 1157. As such, those two extension bars are compressively fixed by the screws fastened between them.

[97] As mentioned above, holes are formed in case where the mount grooves 1157 and 1159 of the lower connecting member are engaged with the mount grooves 1161 and 1162 of the upper connecting member, and the first and the second extension arms 1107 and 1120 of the first fixing unit are inserted into the holes and screws are then insertedly fitted into the screw holes 1163 and 1164.

[98] FIG. 23 is a perspective view representing a state that the device for fixing spinous process shown in FIG. 18 is connected to a vertebral fixing device, and FIG. 24 is a plan view representing a state that the device for fixing spinous process shown in FIG. 18 is connected to a vertebral fixing device.

[99] Referring to FIGs. 23 and 24, the rod insertion parts 1143 and 1143' of the left and right rod fixing links 1141 and 1141' of the transverse bar 1140 are placed over the rods 21 of the vertebral fixing device including vertebra screws 23 for fixing the rods to the spine. After the rods are inserted to the rod insertion parts in such a way, screws are insertedly fitted into the screw holes 1147 and 1147', thereby fixing the spinous process fixing device of the present invention between the opposite rods.

[100] As illustrated in the plan view of FIG. 24, the extension bars 1145 and 1145' of the left and right rod fixing links 1141 and 1141' are eccentrically inserted into the hollow tube shaped insertion holes that are adjacently arranged side by side in the lower connecting member, and screws are insertedly fitted into the screw holes 1156 and 1157. As a result, these two extension bars 1145 and 1145' are compressively fixed by those screws.

[101] FIG. 25 is a plan view representing a state that the device for fixing spinous process of the present invention is implanted in the spine. As depicted in FIG. 25, when the head portion 1005 of the first fixing unit is placed over the upper portion of the spinous process and a recess portion 1131 of the second fixing unit 1130 supports the lower

portion of the spinous process, the spinous process 131 is fixed between the head portion 1005 of the first fixing unit and the recess portion 1131 of the second fixing unit.

[102] In another embodiment, the spinous process fixing device of the present invention, as shown in FIG. 26, may include at least two of the second fixing units 1130 and 1130' so as to fix many spinous processes on the spine. The head portion 1005 of the first fixing unit 1110 is then placed over the spinous process on the top, and the plurality of second fixing units 1130 and 1130' support the spinous processes from below, respectively. Meanwhile, the first and the second fixing units may be used by connecting to the transverse bar, as shown in FIG. 27.

[103] In the spinous process fixing device of the present invention, the cross-sectional shape of the extension bars 1145 and 1145' of the left and right rod fixing links 1141 and 1141' of the transverse bar may be a polygon such as a square as illustrated in FIG. 28 or a pentagon as depicted in FIG. 29, except for a circle. As such, if the cross-section of the extension bars of the rod fixing links is not in a circular shape, it is possible to prevent the rod fixing links from rotating. On the other hand, if the extension bars 1145 and 1145' extended from the rod insertion parts 1143 and 1143' are produced in a polygonal shape, the insertion hole 1153 of the lower connecting member 1150 is configured in a square or pentagon shape to have a cross-sectional shape corresponding to it, too. In another embodiment, the rod fixing links may be configured in the form of sheets.

[104] Meanwhile, the spinous process fixing device of the present invention may include an elastic structure that can accommodate the movement of the spine in a portion of the first and the second extension arms 1007 and 1120. This elastic structure provides flexibility so that the device can be bent according to the movement of the spine when a patient bends his or her body. Accordingly, it becomes possible to prevent degenerative deformity on the spine after back surgery.

[105] Such an elastic structure may be realized by a variety of methods. First, instead of making the first and the second extension arms with metal, they may be embodied by using shape-memory alloys, polyester band and the like with elasticity to a certain extent. Another option is that a part of the first and the second extension arms may be in the form of a spring, metal wire, coil or sheet.

[106] The components of the present invention as described above may be manufactured as independent parts, or conversely, as one integrated unit for convenience of the operation procedure or the manufacture. For example, if the transverse bar is comprised of the two rod fixing links formed on the left and right sides, it has an advantage in that the space between the rods can be adjusted randomly. Besides, instead of doing so, the rod fixing links of the transverse bar may also be integrated

into one body. In such a case, the rod insertion parts 1143 and 1143' holding the rods on both tips of the extension bar 1145 are extendedly formed. As such, if the left and right rod fixing links 1141 and 1141' of the transverse bar are integrated into one body, only one insertion hole can be formed in the lower connecting member 1160, as shown in FIG. 29. Also, the transverse bar and the upper and the lower connecting members may be formed as one integrated unit.

[107] The device for fixing spinous process of the present invention may be made from a synthetic resin, metal, or a material used for an artificial ligament. Alternatively, the device may be made from a material selected from the group consisting of bone-cement, ceramic, titanium, and silicon, but not limited thereto. Furthermore, each component of the spinous process fixing device of the present invention may be manufactured in the form of a wire or a sheet so as to flexibly cope with the movement of a patient's body. Although the above embodiments are illustratively explained with respect to the structure that the respective components are interconnected by screws, different meanses except the screws may be employed depending on the materials used for the respective components or their shapes for the above purpose.

[108] Although the preferred embodiments of the present invention have been disclosed for illustrative purposes, those skilled in the art will appreciate that various modifications and variations are possible, without departing from the technical spirit of the invention as disclosed in the accompanying claims

# Claims

[1] A device for fixing spinous process, comprising:
an extension arm extended to a spinous process of an adjacent vertebra;
a first fixing unit provided at one end of the extension arm; and
a second fixing unit that is inserted and guided in the extension arm to face the first fixing unit,
wherein the first fixing unit supports one side of the spinous process and the second fixing unit supports the other side of the spinous process to thereby fix the spinous process of the adjacent vertebra.

[2] The device of claim 1, wherein the first fixing unit is detachably attached to the extension arm, and comprises an insertion tube inserted into the extension arm and a hook attached to one end of the insertion tube.

[3] The device of claim 1, wherein the extension arm further comprises a moving means formed at a predetermined position on the upper side of the first fixing unit, and the second fixing unit is guided while riding on the moving means of the extension arm.

[4] The device of claim 3, wherein the moving means is a screw thread formed on the outer circumferential surface of the extension arm.

[5] The device of claim 4, wherein the moving means is ratches formed on the outer circumferential surface of the extension arm.

[6] The device of claim 1 or claim 4, wherein the second fixing unit comprises:
an insertion tube inserted into the extension arm and guided;
a main hook attached to one side of the insertion tube; and
an auxiliary hook extended downwardly from a predetermined position of the main hook at a predetermined angle of inclination.

[7] The device of claim 5, wherein the second fixing unit comprises:
an insertion tube inserted into the extension arm and guided;
a main hook attached to one side of the insertion tube; and
an auxiliary hook extended downwardly from a predetermined position of the main hook at a predetermined angle of inclination,
the insertion tube having a projection formed on an upper end portion thereof for interworking with the ratches of the extension arm.

[8] The device of claim 6, wherein the insertion tube of the second fixing unit is inserted into the extension arm and then fixed to the extension arm by bolts provided in the lateral surface thereof.

[9] The device of claim 6, wherein the insertion tube of the second fixing unit is inserted into the extension arm and then fixed to the extension arm by nuts that

are arranged at the upper and lower parts of the insertion tube and screwed onto a screw thread of the extension arm.

[10] The device of claim 1, wherein the extension arm is connected to a transverse bar of a vertebra fixing device via a connection member.

[11] The device of claim 1, wherein the extension arm is connected through a connection member attached onto a rod of a vertebra fixing device.

[12] The device of claim 10, wherein the connection member comprises:
a transverse bar fixing unit of a predetermined length to which the transverse bar is insertedly fixed; and
an extension arm fixing unit which is disposed to be intersected with the transverse bar fixing unit and into which the extension arm is insertedly fixed.

[13] The device of claim 12, wherein the transverse bar fixing unit is a hollow tube shaped member into which the transverse bar is insertedly fixed, the extension arm fixing unit is a hollow tube shaped member to which the extension arm is insertedly fixed, and the transverse bar and the extension arm are fixed by bolts that pass through each of the hollow tube shaped members.

[14] The device of claim 12, wherein the transverse bar fixing unit is a member that is slidingly inserted into both sides of the transverse bar in a plate shape with a guide slot formed on lateral surfaces, and the extension arm fixing unit is a hollow tube shaped member which is provided at a predetermined position of the transverse bar fixing unit and to which the extension arm is insertedly fixed, the transverse bar fixing unit being position-fixed by bolts that are screwed into plural through holes arranged at the plate-shaped transverse bar at regular intervals and the extension arm fixing unit being connected to the extension arm by bolts.

[15] A device for fixing spinous process, comprising:
a first fixing unit including a head portion placed over an upper portion of a spinous process and a first extension arm extended from the head portion;
a second extension arm extended form the head portion to be in parallel with the first extension arm; and
a second fixing unit for fixing the spinous process by passing through the first and the second extension arms and supporting a lower portion of the spinous process.

[16] The device of claim 15, wherein the second fixing unit has two insertion holes through which the first and the second extension arms pass, and the device further comprises at least one screw hole for fixing the second fixing unit onto the first and second extension arms.

[17] The device of claim 15, wherein the second extension arm is configured

detachably from the head portion of the first fixing unit.

[18] The device of claim 1, further comprising at least two of second fixing units for fixing many spinous processes all together.

[19] The device of claim 1, further comprising:
a transverse bar for interconnecting opposite rods of a vertebral fixing device; and
a connecting member for fixing the first and the second fixing units to the transverse bar.

[20] The device of claim 19, wherein the transverse bar comprises two rod fixing links formed on the left and right sides in which rod insertion parts for encompassing rods are formed at contact areas with a pair of the opposite rods, and the left and right rod fixing links are connected to each other by the connecting member.

[21] The device of claim 20, wherein the connecting member comprises:
a lower connecting member for connecting the left and right rod fixing links of the transverse bar; and
an upper connecting member for fixing the first and the second extension arms, the lower connecting member having mount grooves formed on an upper surface and the upper connecting member having mount grooves formed on a lower surface for holding the first and the second extension arms, respectively.

[22] The device of claim 21, wherein the lower connecting member comprises:
insertion holes to which two transverse bars are insertedly fixed;
two screw holes for fixing the lower connecting member to the transverse bar; and
two screw holes for connecting the upper connecting member to the lower connecting member.

[23] The device of claim 21, wherein the upper connecting member has at least one screw hole for fixing the upper connecting member to the lower connecting member after the first and the second extension arms are inserted into the mount grooves between the upper and the lower connecting members.

[24] The device of claim 22, wherein a cross-sectional shape of the insertion hole is a circle or a polygon.

[25] The device of claim 15, further comprising an elastic structure formed at a portion of the first and the second extension arms for accommodating the movement of spine.

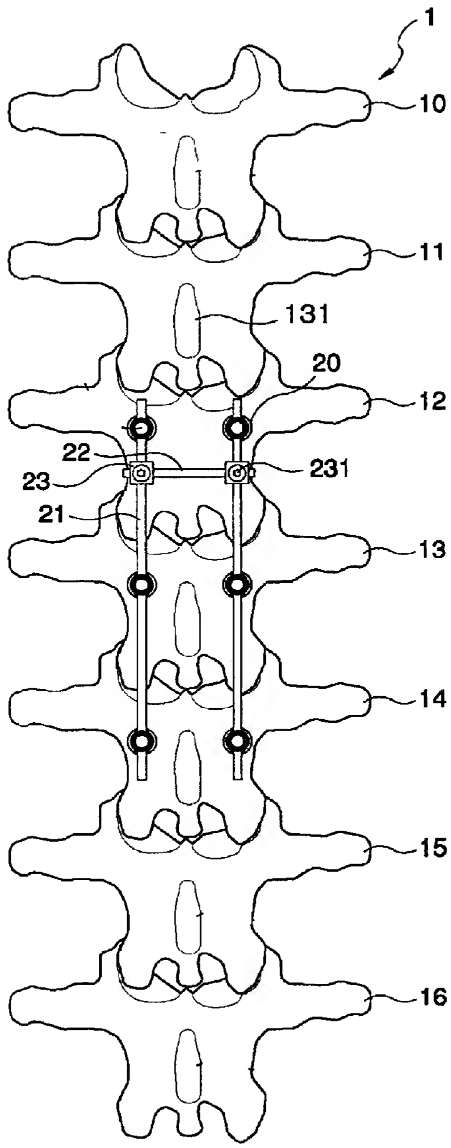
[26] The device of claim 25, wherein the elastic structure is made of shape-memory alloys or polyester band.

[27] The device of claim 25, wherein the elastic structure formed at a portion of the

first and the second extension arms is in the form of a spring, metal wire, or coil.

[28] The device of claim 19, wherein the left and right rod fixing links of the transverse bar are formed as one integrated unit and one insertion hole is formed in the lower connecting member.

[Fig. 1]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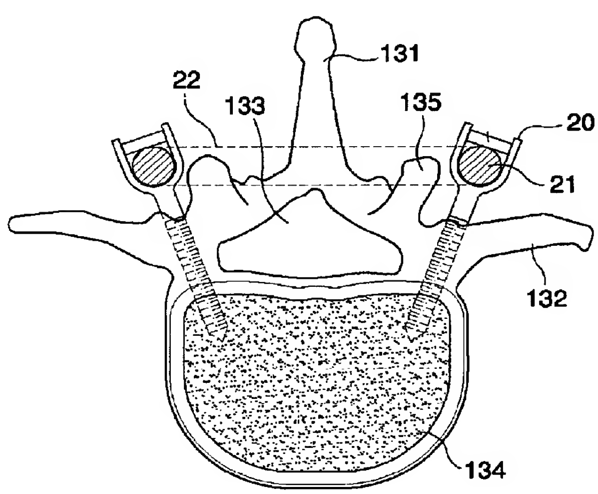
[Fig. 2]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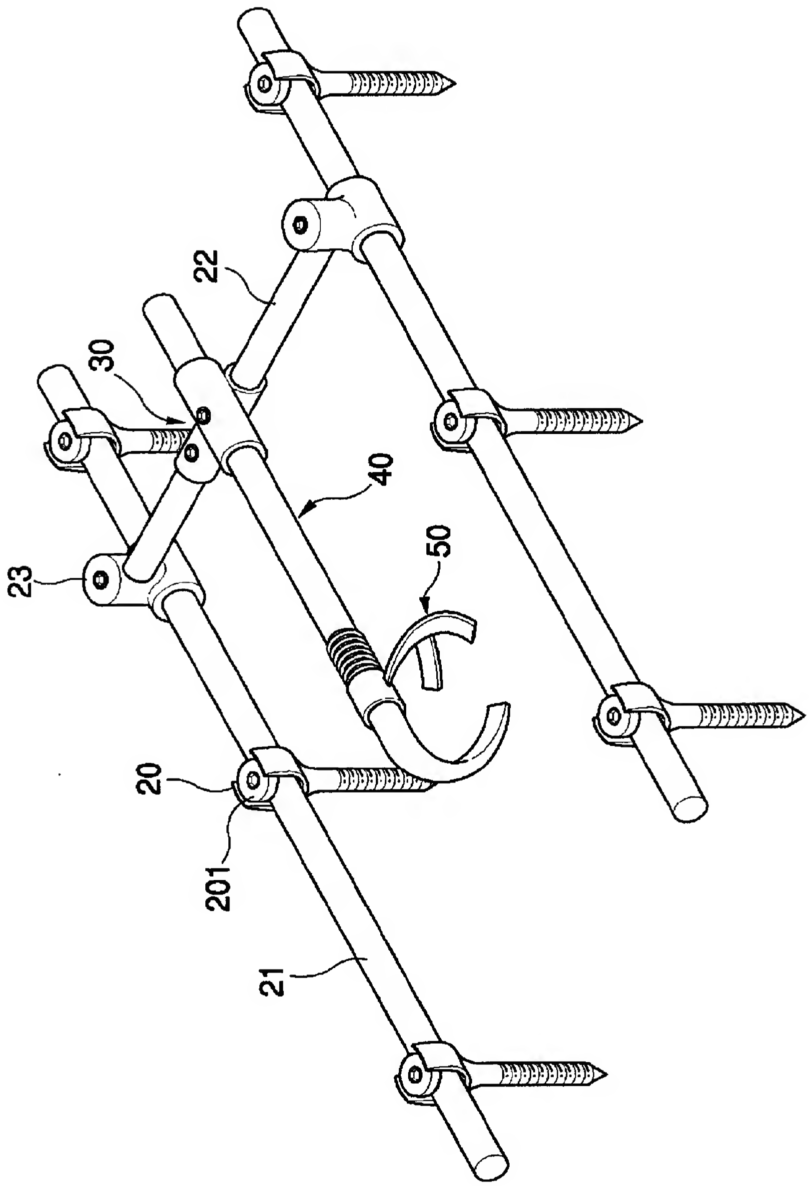
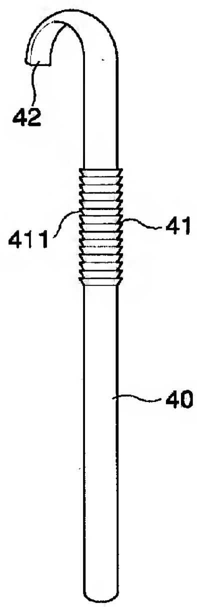
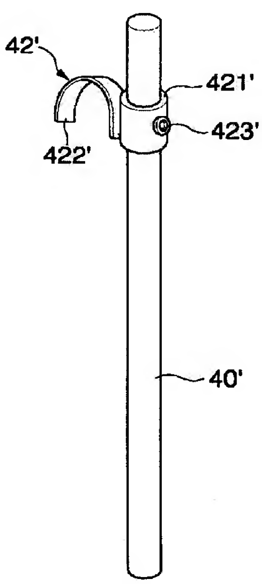
[Fig. 3]



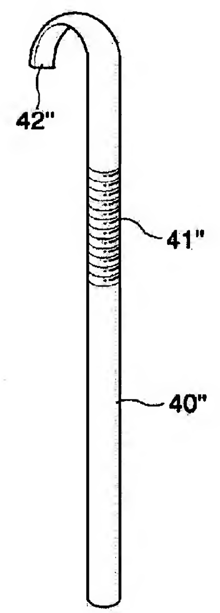
[Fig. 4]



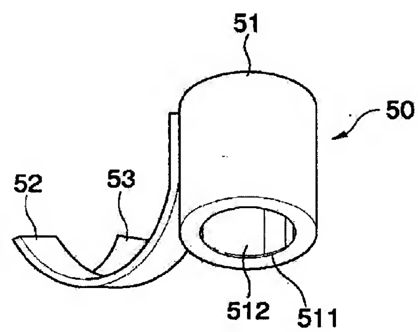

[Fig. 5]



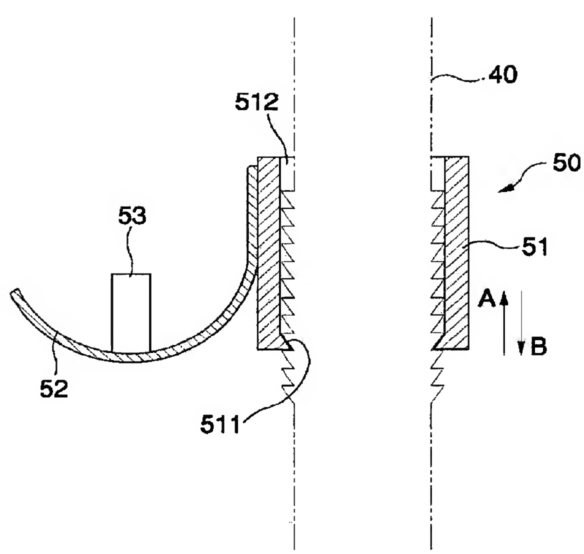
[Fig. 6]



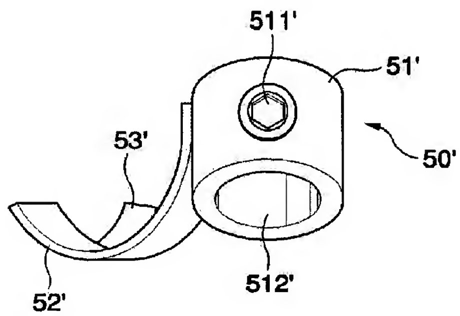

[Fig. 7]



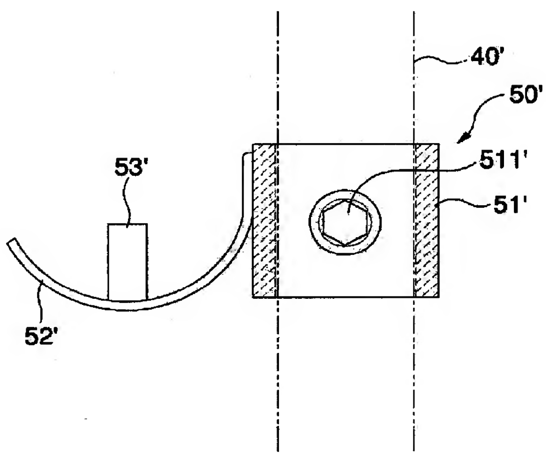

[Fig. 8]



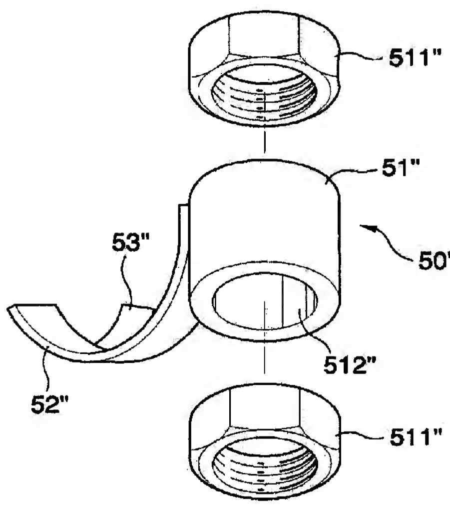
[Fig. 9]



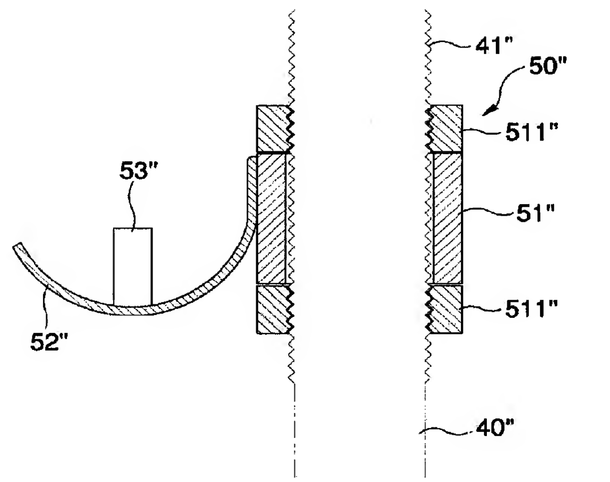

[Fig. 10]



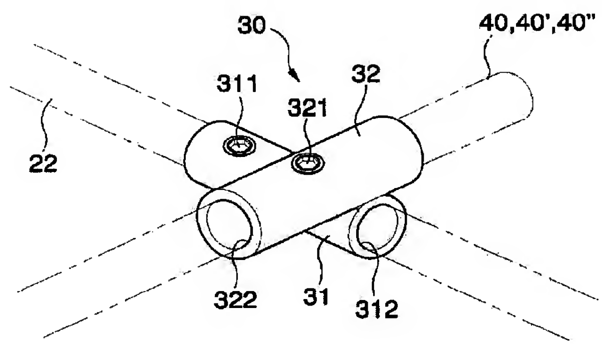

[Fig. 11]



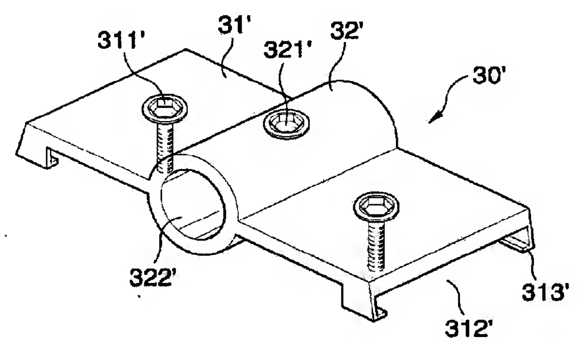
[Fig. 12]



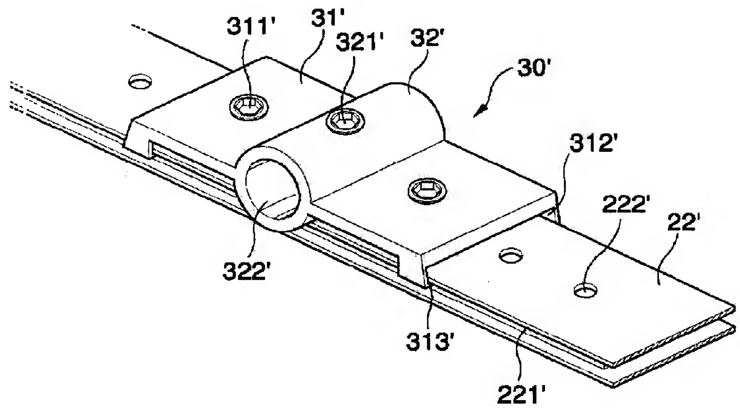

[Fig. 13]




[Fig. 14]



[Fig. 15]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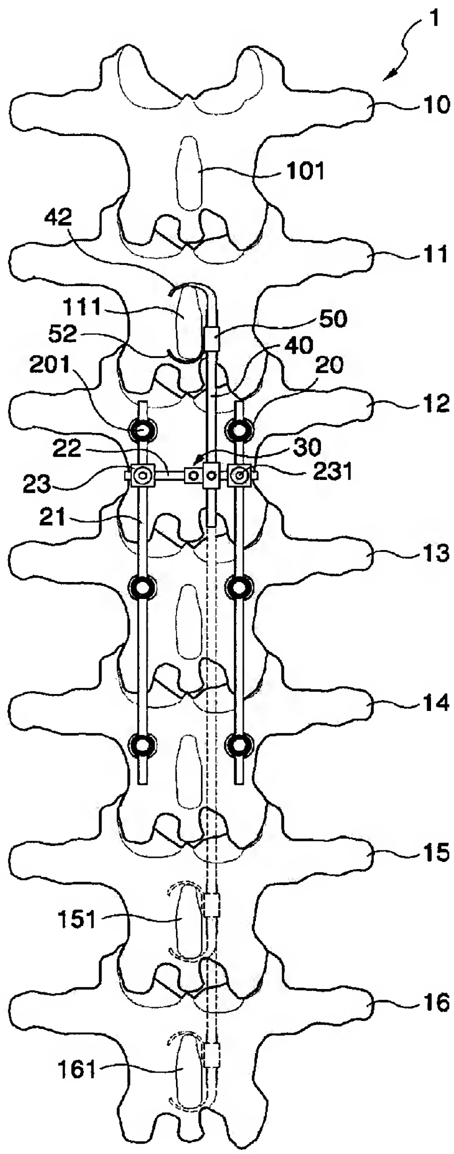
[Fig. 16]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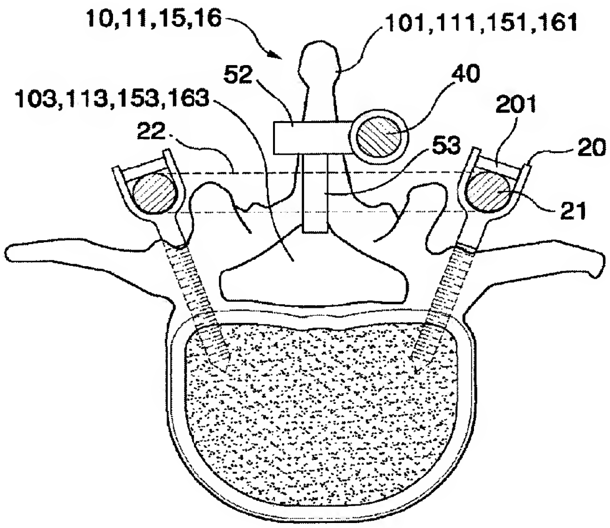
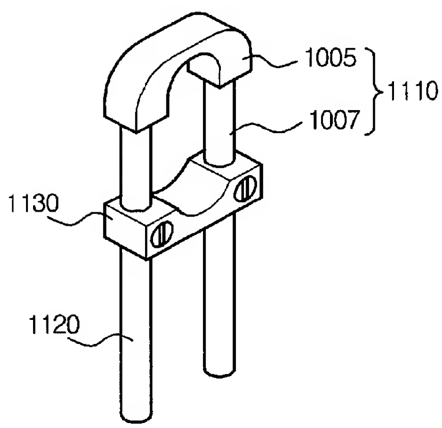
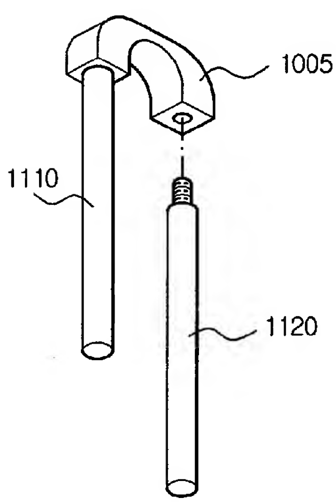
[Fig. 17]



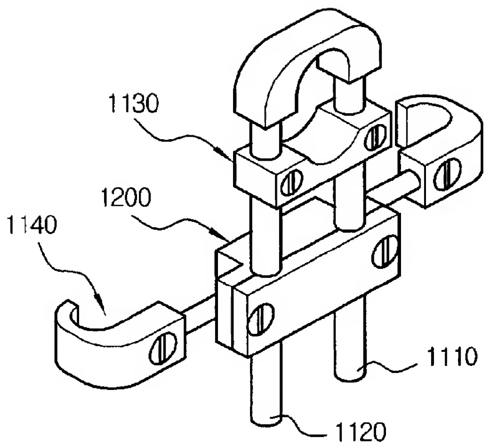

[Fig. 18]




[Fig. 19]



[Fig. 20]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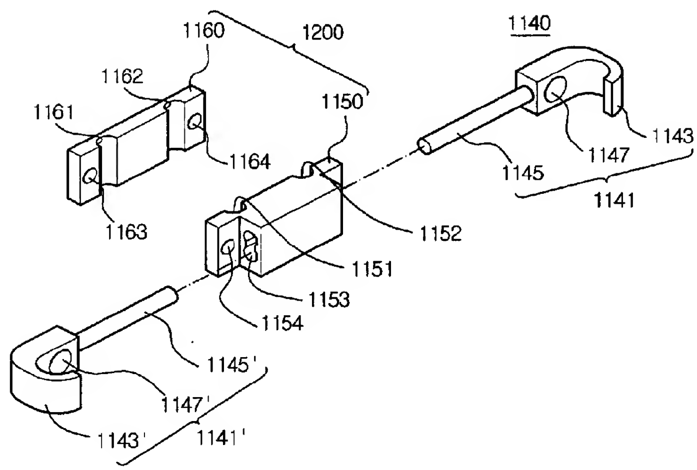
[Fig. 21]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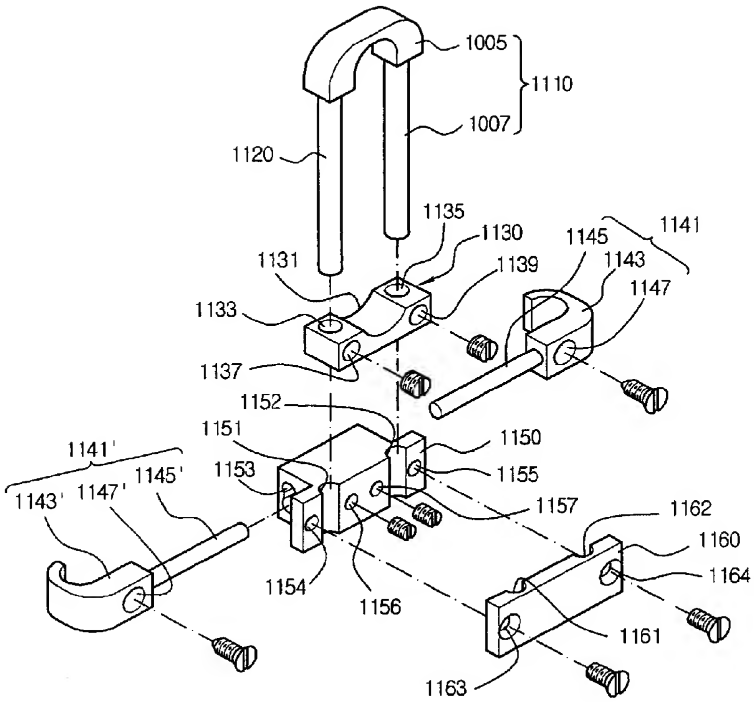
[Fig. 22]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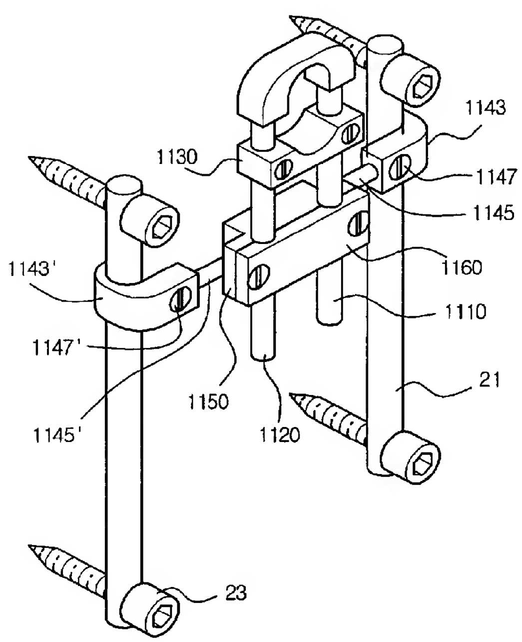
[Fig. 23]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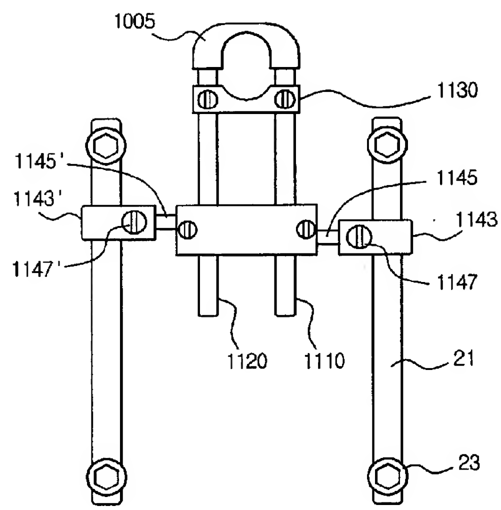
[Fig. 24]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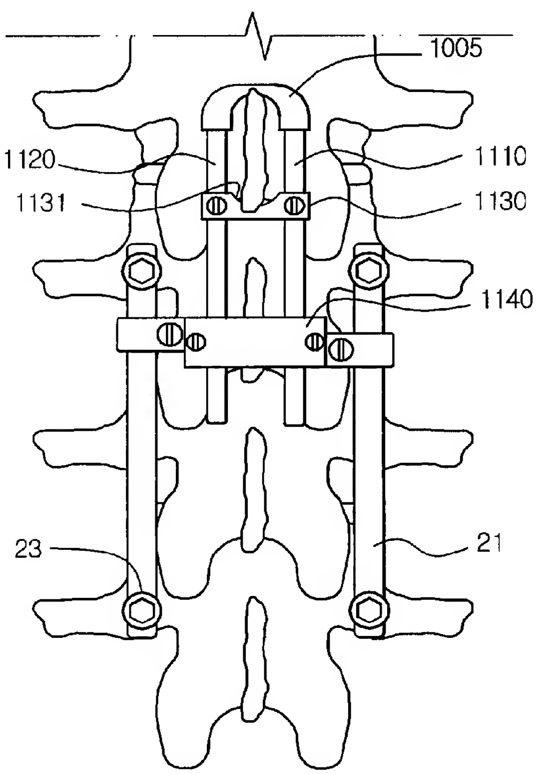
[Fig. 25]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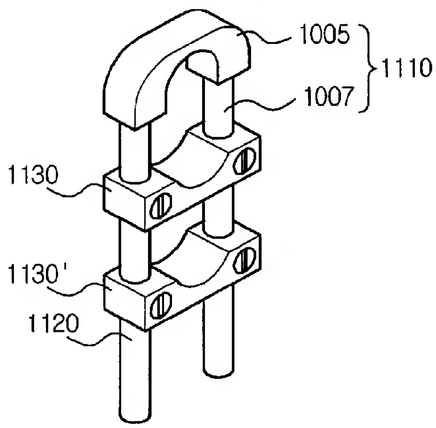
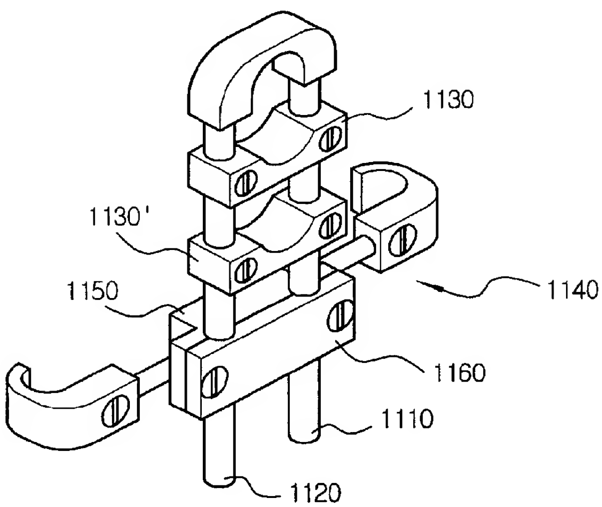
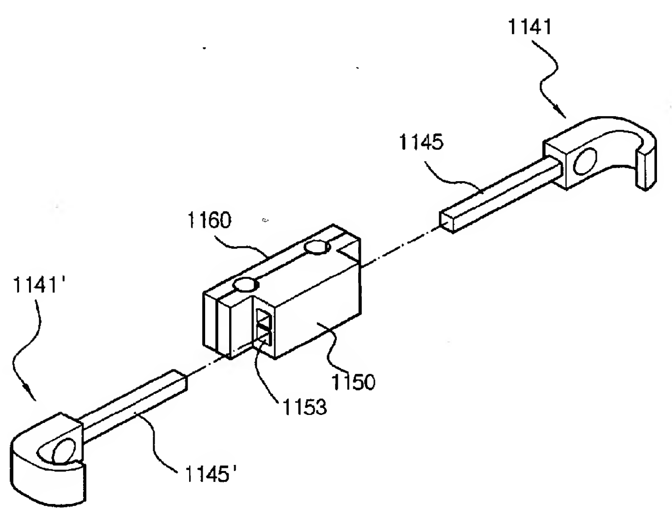
[Fig. 26]



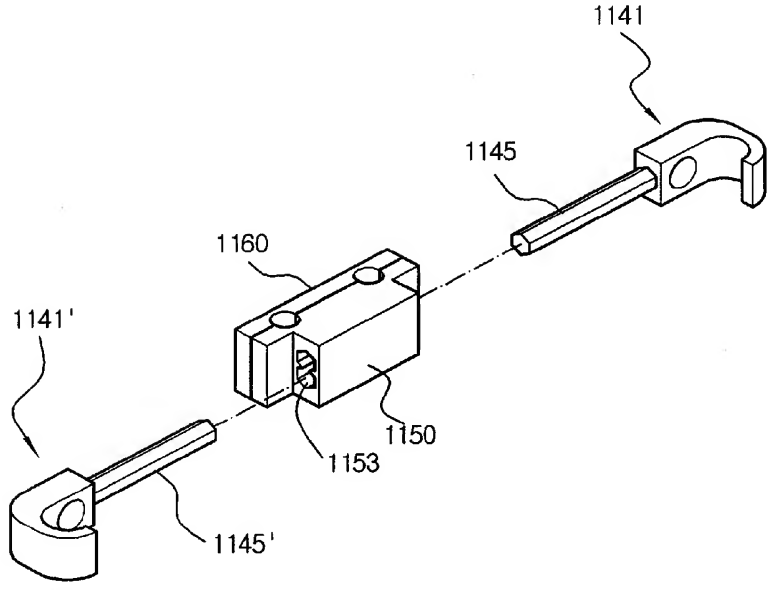

[Fig. 27]




[Fig. 28]



[Fig. 29]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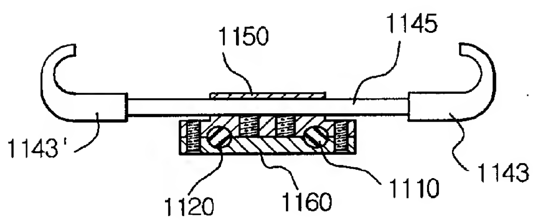
[Fig. 30]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**INTERNATIONAL SEARCH REPORT**

International application No.
PCT/KR2006/004576

**A. CLASSIFICATION OF SUBJECT MATTER**

***A61B 17/70(2006.01)i***

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

IPC 8 A61B 17/70

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean Patents and applications for inventions since 1975
Korean Utility models and applications for Utility models since 1975
Japanese Utility models and application for Utility models since 1975

Electronic data base consulted during the intertnational search (name of data base and, where practicable, search terms used)

eKIPASS(KIPO internal), Delphion

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| A | US 6,652,527 B2 (St. Francis Medical Technologies, Inc.) 25 November 2003<br>See the whole documents. | 1-28 |
| A | KR 10-2005-0000425 A (SDGI Holdings, Inc.) 03 January 2005<br>See the whole documents. | 1-28 |
| A | US 6,364,883 B1 (Santilli, Albert N.) 02 April 2002<br>See the whole documents. | 1-28 |

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents,such combination being obvious to a person skilled in the art
"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 04 JANUARY 2007 (04.01.2007) | **13 FEBRUARY 2007 (13.02.2007)** |

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| Facsimile No. 82-42-472-7140 | Telephone No. 82-42-481-8160 |

**INTERNATIONAL SEARCH REPORT**
Information on patent family members

International application No.
PCT/KR2006/004576

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---|---|---|
| US6652527B2 | 25.11.2003 | US20020116000A1 | 22.08.2002 |
| KR1020050000425A | 03.01.2005 | AU2003225270A1 | 12.12.2003 |
| | | AU2003225270AA | 12.12.2003 |
| | | CA2485174AA | 04.12.2003 |
| | | CA2485174A1 | 04.12.2003 |
| | | CN1652727A | 10.08.2005 |
| | | EP01418854A1 | 19.05.2004 |
| | | EP1418854A1 | 19.05.2004 |
| | | JP17525907 | 02.09.2005 |
| | | JP2005525907T2 | 02.09.2005 |
| | | US07048736 | 23.05.2006 |
| | | US2003216736A1 | 20.11.2003 |
| | | US2003216736AA | 20.11.2003 |
| | | US7048736BB | 23.05.2006 |
| | | WO03099147A1 | 04.12.2003 |
| | | WO2003099147A1 | 04.12.2003 |
| US6364883B1 | 02.04.2002 | US6364883BA | 02.04.2002 |